(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 550 137 A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 92310096.0

(22) Date of filing: 04.11.92

(51) Int. Cl.[5]: A23B 4/027, A23B 4/20, A23B 4/26

(30) Priority: 12.11.91 US 790047

(43) Date of publication of application: 07.07.93 Bulletin 93/27

(84) Designated Contracting States: AT BE CH DE DK ES FR GB GR IE IT LI LU NL PT SE

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(54) Control of microorganisms in the butchering of fowl.

(57) A process for butchering fowl which comprises a step wherein said fowl is treated with water comprising introducing an effective amount of a bromide (for example, KBr, NH_4Br, or NaBr) and an oxidant to control microorganisms. The process is especially suitable for poultry such as chicken and turkey.

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This invention concerns the control of microorganisms in the butchering of fowl.

Ozone has been suggested as an antimicrobial in poultry chiller water by Shelton, et al., Efficacy of Ozone as a Disinfectant for Poultry Carcasses and Chill Water, Journal of Food Science, Volume 51, No. 2, 1986.

Use of 60°C water and 200 ppm chlorine or 2.5% potassium sorbate were suggested to control Salmonella in chicken by Morrison, et al., Reduction of Salmonella on Chicken Carcasses by Immersion Treatments, Journal of Food Protection, Vol, 48, November 1985.

Chlorination of poultry spray washer or chiller tank water was discussed in Bailey, et al., Contamination of Poultry during Processing, The Microbiology of Poultry Meat Products, Chapter 5, pp. 193, et. seq. and Chlorine Spray Washing to Reduce Bacterial Contamination of Poultry Processing Equipment, 1986 Poultry Science 65:1120-1123.

The state of the art in the field of preservation of poultry products was described by Cunningham, Methods of Preservation of Poultry Products, The Microbiology of Poultry Meat Products, Copyright 1987 by Academic Press Inc., pp. 275, et. seq.

The use of an acid polyformate salt to eliminate Salmonella during poultry processing was patented by Parker, U.S.-A-4,766,646.

The use of salt water, antimicrobials, and antioxidants in poultry processing are described by Brockington, et al., in U.S.-A-4,667,370.

Sodium chloride and potassium sorbate were used to control microbial growth in poultry by Sofos, Antimicrobial Activity and Functionality of Reduced Sodium Chloride and Potassium Sorbate in Uncured Poultry Products, Journal of Food Science, Volume 51, No. 1, 1986, p.16.

Organic N-halamines of the classes oxazolidinones and imidazolidones were shown to be useful as poultry processing antimicrobials by Smith, et al., Potential Uses of Combined Halogen Disinfectants in Poultry Processing, 1990 Poultry Science 69:1590-1594 and Williams, et al., Research Note: Combined Halogen Disinfectants in Poultry Processing, 1990 Poultry Science 69:2248-2251.

Except for the aforementioned organic N-halamines, the use of bromine chemistry has not been suggested for poultry processing antimicrobials.

Bromine chemistry is a very well known alternative to chlorine chemistry in other fields, e.g., industrial (i.e., cooling towers, condensers, etc.) and municipal systems (wastewater, etc.). Sodium bromide supplementation of chlorine and bromochlorodimethylhydantoin (BCDMH) were studied by Alleman, et al., 54 Comparative Evaluation of Alternative Halogen-Based Disinfection Strategies, 42nd Purdue University Industrial Waste Conference Proceedings, pp. 519, and Sergent, Enhanced Water Management Using Bromine Chemistry, presented at the 1986 Cooling Tower Institute Annual Meeting, Houston, TX, January 27-29, 1988 as Technical Paper Number TP-86-9.

Combinations of chlorine-bromide, chlorine dioxide-bromide, and monochloramine-bromide were studied as reported by Cooper, et al., Bromide-Oxidant Interactions and THM Formation: A Literature Review, Management and Operations, Journal AWWA, pp. 116, but again, no suggestion regarding poultry processing was made.

Finally, the use of hypobromous acid formed from bromine replacement of hypochlorous acid was patented by Schlid, et al., U.S.-A-4,872,999, for removal of mussels and barnacles from salt or brackish water.

Cost is a major factor in the fowl butchering industry. In the poultry processing industry, about 200 to 400 ppm of chlorine is most typically used in the chill tank to prevent cross contamination and to extend the shelf life of the butchered poultry, as described by Cunningham, supra. Chlorine has certain disadvantages and limitations, however. For example, the amount which can be practically used is limited by chlorine's affect on the carcass. Another limitation is the need to limit the amount of chlorine in the effluent due to adverse environmental affect on groundwater and the like.

Other processes which have been suggested, for example the use of N-halamines by Smith, et al, and Williams, et al, supra, have disadvantages in that they are relatively expensive and are thus considered inefficient in the industry.

It is an object of the present invention to provide a fowl butchering process which allows for a dramatic reduction in the amount of chlorine disinfectant used or elimination of chlorine entirely. Another object is to provide a very efficient and effective method of disinfection in the fowl butchering process.

Accordingly the present invention provides in one aspect a process for butchering fowl comprising a step in which said fowl is treated with water, wherein amounts of a bromide and an oxidant effective to control microorganisms are introduced into said water.

Fowl butchering processes generally comprise one or more water treatment steps. Typically such processes include both a scald tank or step and a chill tank or step. We conceive of use of a bromide and an oxidant being introduced in either or both of these steps, or in any other steps which utilize water, as antimicrobials in effective amounts to control Salmonella and other undesirable microorganisms.

The preferred oxidants are selected from the group consisting of chlorine, hydrogen peroxide, sodium hypochlorite, sodium persulfate, sodium perborate, potassium persulfate, sodium permanganate, potassium permanganate, chlorine dioxide, peracetic acid, and ozone and organic peroxides such as t-butyl hydroperoxide.

The preferred bromides are selected from KBr, NH_4Br, and NaBr. $CaBr_2$ is also suitable. Sodium bromide is most preferred because of its availability.

The preferred concentration of bromide and oxidant is such as to achieve residual bromine levels of about 0.1 to 20 ppm, preferably about 0.3 to 5 ppm, measured about five minutes after treatment. The bromide and oxidant are introduced in a molar ratio of about 0.08 to 2.0 of bromide to oxidant, preferably about 0.1 to 1.0.

The types and effective amounts of bromide and oxidant used will depend upon the type of and quality of birds to be treated and the temperature and composition of the water into which they are being introduced.

One or more active bromine species are generated in situ according to this invention. In the case of NaBr and KBr, the active bromine species is HOBr.

The bromide and oxidant of the present invention will be effective even in the presence of amines which adversely affect other known techniques. Microorganisms are substantially eliminated in the water and in the fowl by this process.

EXAMPLES

The following examples illustrate a few embodiments of the invention. It is to be understood that these examples are for purpose of illustration only and should not be considered as limiting.

Example 1

In a poultry processing plant operating continuously around the clock, in which about 20 µg/ml chlorine has been used in the water in each chiller to reduce the number of microorganisms (such as Salmonella) on the carcasses as they go through the chillers, a bromide is used to replace one half of the chlorine, on a molar basis, based on the following protocol:

A. Calculate the moles of chlorine being applied to the chiller water. For example, for every 1000 gallons (4546 litres) of water treated at 20 µg/ml of chlorine, 1068 moles or 75.7 kg of Cl_2 are used.

[(1000 gal)(3785 ml/gal)(20 µg/ml Cl_2)(1 µmole/70.9 µg Cl_2)(1 mole/1000 µmole) = 1068 moles or 75.7 kg of chlorine.]

B. Calculate the weight of sodium bromide needed to apply a 1:1 molar ratio of sodium bromide to chlorine. For example, 1068 moles of sodium bromide is 110 kg of sodium bromide or 290 kg of a 38% aqueous solution of sodium bromide.

[(1068 moles NaBr)(102.9 g/mole)(1 kg/1000 g)]

C. Apply 75.7 kg of chlorine and 110 kg of sodium bromide per 1000 gallons of chiller water, preferably by pre-mixing the chlorine and sodium bromide in deionized or tap water.

D. Depending on the pH of the chiller water and the levels of organics, especially amines, present in the water, active bromine can be effective at a lower level than chlorine. Monitor the performance of the the total bromine replacement (as calculated above) by regularly determining residual oxidant levels in the chiller water, and microorganism levels in the chiller water and on carcasses. Once a baseline performance is established, maintain the 1:1 molar ratio of sodium bromide to chlorine and gradually reduce the overall levels of sodium bromide and chlorine applied to the chiller water until further reduction results in detection of unacceptable levels of microorganism. Return to the lowest sodium bromide and chlorine level which provides the desired residual oxidant and microorganism levels.

Example 2

This example illustrates partial replacement of chlorine with active bromine.

A. In the same poultry processing plant as the preceding example, replace about 25% (on a molar basis) of the chlorine with active bromine. If 20 µg/ml Cl_2 (0.28 µmole/ml) is being used in the chiller water, treat the chiller water with 20 µg/ml Cl_2 and 7.2 µg/ml sodium bromide (0.07 µmole/ml). Preferably, the chlorine and sodium bromide are premixed in deionized or tap water to preform HOBr prior to application to the chiller water.

B. Monitor the performance of the chlorine/bromine mixture by regularly determining residual oxidant levels in the chiller water, and microorganism levels in the chiller water and on carcasses. Once a baseline performance has been established, reduce the chlorine level by about 10-25%.

C. Monitor the performance of the new chlorine/bromine mixture as in B above. If the performance continues to be acceptable, reduce the chlorine level once more by about 10-25%. Continue this process until a further chlorine reduction results in detection of unacceptable levels of microorganism.

D. Return to the lowest chlorine level that provided adequate control of microorganism levels.

While the present invention has been described in detail, various modifications and alternatives should become readily apparent to those skilled in the art.

Claims

1. Process for butchering fowl comprising a step in which said fowl is treated with water, wherein

amounts of a bromide and an oxidant effective to control microorganisms are introduced into said water.

2. Process according to claim 1 wherein an active bromine species is generated in situ in said water from the reaction of said bromide and said oxidant.

3. Process according to claim 2 wherein the amount of residual bromine generated in situ in said water is from 0.1 to 20 ppm, preferably from 0.3 to 5 ppm based on water, measured 5 minutes after introducing said bromide and said oxidant.

4. Process according to any preceding claim wherein said bromide and oxidant are introduced in a molar ratio of from 0.08 to 2.0 of bromide to oxidant, preferably from 0.1 to 1.0.

5. Process according to any of claims 2 to 4 wherein said bromide and oxidant are premixed in water prior to addition to the treatment water so as to preform said active bromine species.

6. Process according to any preceding claim wherein said oxidant is chlorine, hydrogen peroxide, sodium hypochloride, sodium persulfate, potassium persulfate, sodium perborate, sodium permanganate, potassium permanganate, chlorine dioxide, peracetic acid, ozone or t-butyl hydroperoxide.

7. Process according to any preceding claim wherein said bromide is KBr, NH_4Br or NaBr.

8. Process according to claim 6 or 7 wherein said active bromine species is HOBr.

9. Process according to any preceding claim wherein said bromide and said oxidant are introduced in a chill tank and/or a scald tank.

10. Fowl which have been butchered by a process according to any preceding claim.

11. Use of a combination of bromide and oxidant as defined in any preceding claim to control microorganisms in water used in the butchering of fowl.

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(43) Date of publication of application:
07.07.93 Bulletin 93/27

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IE IT LI LU NL PT SE

(88) Date of deferred publication of search report:
25.08.93 Bulletin 93/34

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EUROPEAN SEARCH REPORT

Application Number

EP 92 31 0096

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-4 643 835 (S. KOEPLIN-GALL ET AL.) 17 February 1987 * column 1, line 33 - column 3, line 5; claims *	1,2,4, 6-8,10, 11	A23B4/027 A23B4/20 A23B4/26 A23B4/24
Y	US-A-4 021 585 (D. J. SVOBODA ET AL.) 3 May 1977 * the whole document *	1,2,4, 6-8,10, 11	
X	GB-A-17 400 (A.D 1913) (GESLLSCHAFT FUR STERILISATION ET AL.) 20 August 1914 * page 1, line 26 - page 2, line 18; claim 1 *	1,7	
A	DE-C-275 870 (GESLLSCHAFT FÜR STERILISATION) 19 April 1913 * the whole document *	1,6,7,8	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	DATABASE WPIL Derwent Publications Ltd., London, GB; AN 85-206053 & JP-A-60 129 182 (HAKUTO KAGAKU KK.) 10 July 1985 * abstract *	3,4,6-8	A23B A23L
A	US-A-4 849 237 (W. D. HURST) 18 July 1989		
A	FR-A-2 224 094 (SWIFT & COMP.) 31 October 1974		
A	WO-A-8 103 110 (BARTA) 12 November 1981		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 JUNE 1993	GUYON R.H.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

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EPO FORM 1503 03.82 (P0401)